

STATEMENT

by Assoc. Prof. Detelin Mihaylov Luchev, PhD

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on a dissertation thesis for the award of the educational and scientific degree "**Doctor**"

Field of Higher Education: 4. Natural Sciences, Mathematics and Informatics

Professional Field: 4.6. Informatics and Computer Sciences

Doctoral Programme: Informatics

Author: Emanuela Dimitrova Mitreva

Topic: Methods and Algorithms for Personalisation and Adaptability in Content Management Systems

Scientific Supervisor: Prof. Desislava Ivanova Paneva-Marinova, PhD, Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

1. General Characteristics

By Order No. 57/17.06.2026 of the Director of IMI-BAS, I have been appointed as a member of the Scientific Jury for the procedure for the defence of a dissertation thesis of Emanuela Dimitrova Mitreva, a part-time PhD student at the Mathematical Linguistics Section of the Institute of Mathematics and Informatics, Bulgarian Academy of Sciences. The statement has been prepared and submitted pursuant to the Decision of the Scientific Jury (Protocol No. 1/02.07.2026) regarding the allocation of duties among the members of the Scientific Jury for the procedure.

This statement has been prepared in accordance with the requirements of the Development of Academic Staff in the Republic of Bulgaria Act (ZRASRB), the Regulations for its Implementation (PPZRASRB), and the Regulations on the Terms and Conditions for Acquiring Scientific Degrees and Holding Academic Positions at the Institute of Mathematics and Informatics, Bulgarian Academy of Sciences.

All necessary documents for the procedure have been provided to me.

2. Relevance of the Topic and Appropriateness of the Formulated Aim and Objectives

The dissertation is dedicated to the highly relevant and significant topic of personalized content presentation in digital libraries. The research focuses on overcoming information overload through the development of methods and algorithms that adapt content to the individual needs and interests of users. Five main research objectives are formulated in the dissertation, systematically covering: a review of the state-of-the-art, the development of an asynchronous NLP/NER service, a conceptual model with a multi-component similarity measure, an architectural prototype, and detailed experimental validation. There is **full alignment between the achieved results and the formulated aim and objectives**.

3. Knowledge of the State of the Problem

The doctoral candidate demonstrates a deep understanding of modern architectural models, vector representations, and personalization algorithms. The review in Chapter 2 accurately

identifies the shortcomings of existing systems – including the "cold start" problem, limited explainability, and constraints when processing specific languages such as Bulgarian.

4. Research Methodology

The methodology employed is scientifically sound. The author combines semantic modeling (vector transformations), mathematical weighted evaluation methods, fuzzy clustering logic, and asynchronous architectural patterns for real-time processing. The conducted experiments include both real digital collections (Digital Library of the "Ivan Vazov" National Library – Plovdiv) as well as synthetic scenarios and ablation tests.

5. General Characteristics of the Dissertation Thesis

The dissertation thesis comprises 167 pages, structured into a table of contents, introduction, five chapters, conclusion, a list of the author's publications on the dissertation topic (5 titles), a list of citations (4), a list of reported results (6), a list of figures (26), a list of tables (15), a glossary of terms and abbreviations, a bibliography of 202 references, and a declaration of originality.

The work is logically and consistently structured, with well-balanced chapters illustrated with appropriate figures and tables.

Chapter 1 clearly defines the research object, scope, aim, and objectives, outlining the working hypothesis for enhancing personalization efficiency through artificial intelligence methods. Chapter 2 presents an in-depth literature review of theoretical foundations and contemporary approaches to personalization in digital libraries. Chapter 3 introduces the original conceptual model and architectural framework of the proposed solution. A multi-layer architecture is developed, featuring an asynchronous layer for computationally intensive operations (named entity extraction, similarity matrix construction, and "user-document" matrix construction) and an interactive layer for low-latency request handling. Chapter 4 presents the practical implementation of the proposed architecture, including the technology stack (Python, PyTorch, Sentence-Transformers, scikit-learn) and the dataset of 1,000 Bulgarian-language periodical publications from the digital library of the "Ivan Vazov" National Library – Plovdiv. Experimental validation includes weighting coefficient calibration via grid search and ablation analysis, alongside tests on synthetic and real-world data. Results indicate that multi-component evaluation leads to more precise similarity modeling in a multi-topic corpus, while the hybrid algorithm demonstrates robustness in edge-case scenarios (cold start, topic shift, exhausted history), achieving Precision@10 of 0.0321, HR@10 of 0.3207, and NDCG@10 of 0.1888, outperforming isolated approaches. Chapter 5 summarizes the obtained results and outlines future research directions, including indicator expansion, dynamic fine-tuning, and infrastructure optimization.

6. Analysis and Assessment of the Scientific and Scientific-Applied Contributions of the Dissertation Thesis

I accept the 3 scientific and 6 scientific-applied contributions formulated in the dissertation, the authenticity of which is fully confirmed in the presented dissertation:

- **Scientific Contributions:** Conceptual model of a two-layer (asynchronous/interactive) architecture; A new formula for multi-component similarity assessment (S_{final}), combining

global semantics, local matches, clustering, and NER; An item-oriented hybrid recommendation algorithm with explainability mechanisms.

- **Scientific-Applied Contributions:** An independent NER microservice for the Bulgarian language; Modules for similar document discovery and hybrid recommendation; Latency optimization and incremental updates; Parametric calibration via ablation analysis and validation across 6 edge-case scenarios ("cold start", rapid interest shift, etc.).

I consider the contributions to be original, well-substantiated, and experimentally validated. They enrich the domain of personalized systems in digital libraries and possess clear practical applicability, proven through implementation and testing on real-world data.

7. Publications on the Topic. Reliability of Results

The list of the author's publications on the dissertation includes 5 titles. One article is published in the journal Applied Sciences (MDPI), Q2 (Web of Science), SJR 0.521, indexed in Scopus and Web of Science; one – in TEM Journal, indexed in Scopus and Web of Science (ESCI), Q4; one – in Lecture Notes in Networks and Systems (Springer), with SJR 0.165, in the process of Scopus indexing; one paper – in the proceedings of CompSysTech'24, indexed in Scopus (SJR 0.253); and one paper – in the proceedings of DiPP 2023, indexed in Scopus and Web of Science. The candidate is the first author of four publications and the sole author of one. Four citations are presented for the defence. Outside the dissertation publication list, the candidate currently has a total of 15 documents in Scopus and 11 in Web of Science, with an h-index of 2 in both of the largest and most established global databases for peer-reviewed scientific literature – Scopus and Web of Science. The results of the dissertation thesis have been disseminated through scientific presentations at international scientific conferences (CompSysTech'24, CVC 2026, DiPP 2023) and annual reporting sessions of the Mathematical Linguistics Section at IMI-BAS. The attached articles demonstrate that the main results are her personal work and align with contemporary research in the field. The requirements of ZRASRB, PPZRASRB, and the Regulations of IMI-BAS for acquiring the educational and scientific degree "Doctor" in professional field 4.6 have been fulfilled. Based on a detailed scientometric evaluation, it is established that the candidate significantly exceeds the minimum national requirements under ZRASRB/PPZRASRB for professional field 4.6. Informatics and Computer Sciences. There is no evidence of plagiarism.

8. Abstract

The abstract, submitted in Bulgarian and English, correctly reflects the structure, content, main results, and contributions of the dissertation thesis. Requirements regarding volume and format have been observed. The lists of publications, citations, and reported results are presented correctly and completely.

9. Critical Remarks and Recommendations

I have no significant critical remarks regarding the dissertation thesis. As a recommendation for future work, I advise the doctoral candidate to expand experimental validation with user studies (e.g., A/B testing) to evaluate perceived relevance and user trust in recommendations, as well as to explore applying the proposed architecture to multilingual corpora.

CONCLUSION

Based on the content analysis of the dissertation thesis, its publications, and scientific and scientific-applied contributions, I consider that the dissertation thesis of part-time PhD student Emanuela Dimitrova Mitreva on "Methods and Algorithms for Personalisation and Adaptability in Content Management Systems" satisfies the requirements of the Development of Academic Staff in the Republic of Bulgaria Act (ZRASRB), the Regulations for its Implementation (PPZRASRB), the Regulations of BAS, and the Regulations of IMI-BAS for the award of the educational and scientific degree "Doctor" in professional field 4.6. Informatics and Computer Sciences, doctoral programme "Informatics". I give a **positive evaluation** of the dissertation thesis and **propose that the esteemed Scientific Jury award Emanuela Dimitrova Mitreva the educational and scientific degree "Doctor"** in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Sciences, doctoral programme "Informatics".

10.08.2026

Member of the Scientific Jury:

Assoc. Prof. Detelin Luchev, PhD